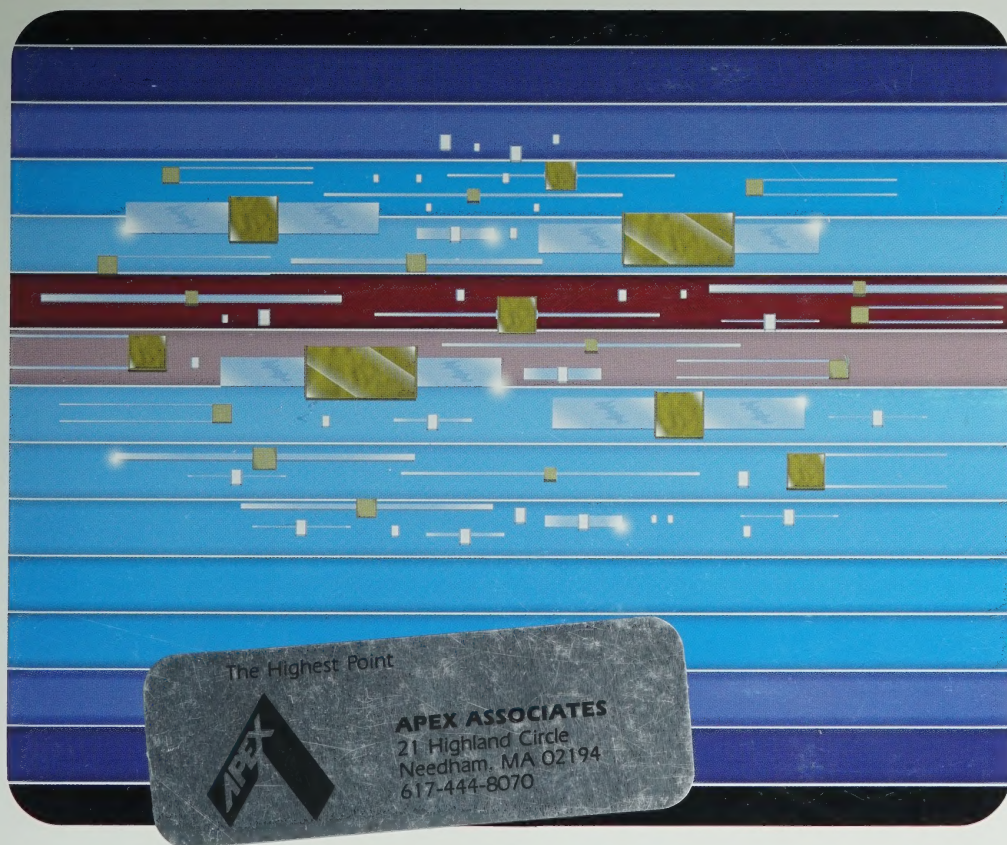


HI-Q MONOLITHIC CAPACITORS

for HF, VHF, UHF, Microwave & Military Applications

CATALOG NO. 63-12



MURATA ERIE NORTH AMERICA
MICROWAVE PRODUCTS GROUP

Tuned to the Future

Murata Erie North America, Inc. (MENA) is a leader in ceramic component manufacture and technology worldwide, and reflects the merger of three prominent and respected component manufacturers-Erie Technological Products, Inc., JFD Electronics Corp. and Murata Corporation of America. Erie Technological Products Corp. has been known for many decades for its high quality large selection of fixed and variable capacitors. JFD, has been a leader in Hi-Rel, high frequency capacitors, both fixed and variable, meeting MIL specification, and has been a supplier to such programs as Gemini, Apollo and Lunar vehicles, and to the military and telecommunications market. Murata Corporation of America has been a world leader in both the manufacture and design of high quality ceramic capacitors and other ceramic-based components. Murata is also a recognized leader in the implementation of automatic production technology.

With this wide span of expertise, the merged company, Murata Erie North America, Inc. offers the industry's largest selection of fixed capacitors for R.F. applications through the microwave frequency range. Advanced design, unique production technology and stringent quality control methods assure a uniform, reliable product.

This catalog contains detailed technical and design information on MENA's line of fixed capacitors for high frequency applications up to and including UHF and Microwave frequencies. In order to provide information which will prove to be useful to the engineer and user in the selection and application of ceramic capacitors, it is necessary to understand basic test and performance methods as well as the terminology involved. For that purpose, this catalog also includes descriptions of the fundamentals needed to adequately understand these products.



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1 - DIELECTRIC:

Sometimes called "Insulator", a dielectric is a material whose internal charges are bound and can therefore only move over atomic dimensions. It separates the conductive capacitor plates and is important in determining temperature characteristics, voltage rating, capacity/volume and other characteristics of a capacitor.

2 - DISSIPATION FACTOR ("DF"):

The dissipation factor of an insulating material is defined as the ratio of energy dissipated to energy stored in the dielectric. The DF is frequency sensitive and must be specified at a given frequency.

3 - QUALITY FACTOR ("Q"):

The Q factor is the ratio of energy stored to energy dissipated and is therefore often taken as the inverse of the DF at low frequency. Sometimes called "Figure of Merit", Q factors must be specified at a given frequency.

4 - WORKING (OR "RATED") VOLTAGE:

Nominal continuous voltage which may be applied to a component with no derating of any kind.

5 - DIELECTRIC WITHSTANDING ("BREAKDOWN") VOLTAGE:

The peak voltage which the component is designed to withstand without damage for short periods of time. This value must be specified in terms of frequency, waveform, and time.

6 - INSULATION RESISTANCE (MEGOHMS):

I.R. is the terminal to terminal DC resistance of a capacitor, and must be specified in terms of voltage, temperature, and relative humidity.

7 - TEMPERATURE COEFFICIENT ("TC"):

"TC" is the decimal change in capacity per degree change in environmental temperature. Some dielectrics are very lossy and generate internal heat and for that reason this test is conventionally conducted under "no load" conditions. The standard definition for "TC" in parts per million per degree centigrade is . . .

$$TC = \frac{(Cx - Co)}{Co} \times \frac{(10^6)}{(Tx - To)} \quad / ^\circ C$$

Where "Tx" is the test temperature, "To" is the reference temperature - usually 25°C. "Co" is the capacity measured at the reference temperature and "Cx" is the capacity measured at the test temperature.

8 - DRIFT:

The extent in pF or % to which capacitor changes value as a result of temperature exposure. Sometimes called "Retrace", this measurement is usually made under nominal (i.e. room) conditions and is accomplished both before and after the conclusion of temperature excursion. (Note: "Drift" may occasionally be used in the test context of the simple passage of time).

9 - VOLTAGE COEFFICIENT:

All high K dielectrics tend to reduce their dielectric coefficient (capacity) in the presence of strong unidirectional electric fields. For some materials, and package designs, this effect can become very dramatic. Lower K materials do not exhibit a similar phenomenon. (Usually specified in pF/volt).

10 - TERMINATION:

This term refers to the material and/or geometry of the terminals of the capacitor.

11 - CHIP, MONOLITHIC OR MULTI-LAYER CAPACITOR:

All of these terms, and any combination of them, refer to a ceramic capacitor style which consists of alternate layers of ceramics and conductive (metallic) surfaces which are compressed and vitrified to form a single "monolithic" structure. Alternate metallic surfaces are then interconnected to form a two terminal capacitor.

12 - ESR:

The sum of the equivalent series resistances of the electrode resistance and loss tangent of the dielectric, otherwise known as the real part of the capacitors equivalent circuit impedance (Note: The dielectric loss tangent is frequency dependent as is ESR).

13 - AGING:

Aging is the change in the dielectric constant as a function of time. Aging is particularly noticeable in high dielectric materials and is measured as a percentage change per decade of time. Aging decreases logarithmically and becomes less apparent with time.

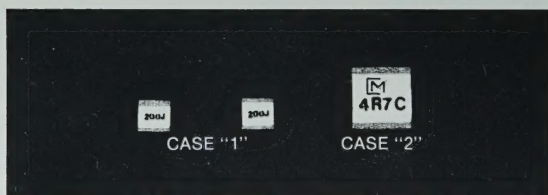
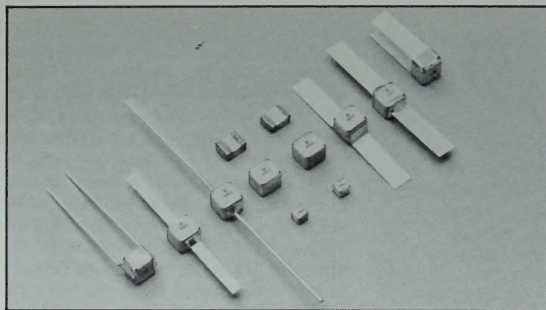
14 - RF POWER:

Typically measured in KVA (apparent power) for signals with frequencies greater than 1 MHz. RF Power is limited by the maximum rated voltage or the maximum power the capacitor is able to dissipate.

15 - KVAR RATING:

Capacitive reactive power, determined by the rated RF voltage or the rated RF current and the equation $KVAR = IESin\theta$ where θ is the angle between current and voltage.

MA SERIES PORCELAIN CERAMIC MICROWAVE CAPACITORS



4X ACTUAL SIZE
(Illustrated with laser marking)

MA Series ceramic fixed capacitors are miniature, high performance precision components having extremely high Q's and high power capabilities from low frequencies to gigahertz ranges. These porcelain multilayer capacitors are extremely stable with variations in temperature voltage and frequency, and are capable of withstanding the environments encountered in space applications.

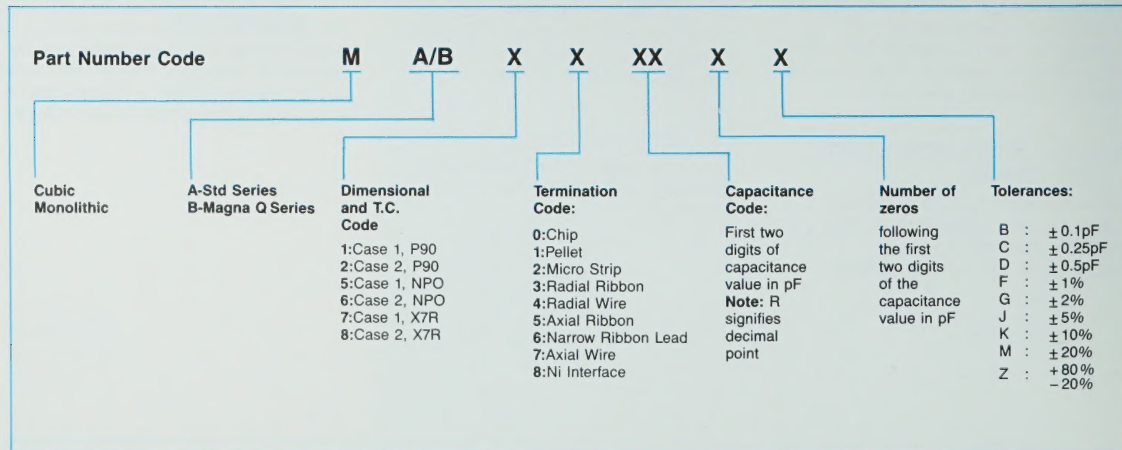
MA Series capacitors are designed for miniature state-of-the-art circuit applications. They are small, easy to apply and have extreme reliability. Units are available in ultra-miniature case size "1" (0.055" x 0.055" x 0.055") or miniature case size "2" (0.110" x 0.110" x .100"). Standard case size "1" units are available as chips or pellets. Standard case size "2" units are available as chips, pellets and also in a variety of leaded configurations. Nickel interface is available on pellet units to provide additional leaching resistance.

Great effort has been made to retain flexibility in the design and manufacture of the MA series while automated production techniques reduce costs and increase reliability. This flexibility permits the design and production of non-standard parts for near standard prices. We invite contact with our applications engineers for special configurations, values, tests, test procedures or data not shown in this catalog.

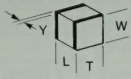

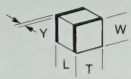
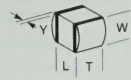
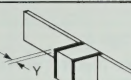
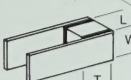
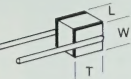

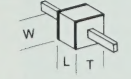


OUTSTANDING CHARACTERISTICS

- Miniature Size
- Very high Q at high frequencies
- High RF power capabilities
- Impervious to environmental conditions
- Low dissipation factors
- Perfect retrace capability
- High temperature stability
- Low noise
- Meets Mil-C-55681 with respect to: Shock, Vibration, Moisture Resistance, Solderability, Barometric Pressure, Temperature Cycling, Immersion and Salt Spray.

ORDERING INFORMATION MA/MB Series



"M" Series Configurations

Style	MIL-C-55681	Type			Case Size	Configuration	Dimensions: in. (mm)			Band	Termination
		P90±20	P90±30	NPO±30			L±.015* (.4)	W±.015* (.4)	T max		
Chip	CDR11	MA10	—	MA50	1		.055±.010 (1.4±.25)	.055±.010 (1.4±.25)	.055 (1.4)	.01±.005 (.25±.1)	Palladium Silver
Pellet	—	MA11	—	MA51	1		.07 Max (1.8 Max)				Palladium Silver & Solder (SN62)
Nickel Inter-Faced Pellet	CDR12	MA18	—	MA58	1						Palladium Silver, Nickel Interface. Solder (SN62)
Chip	CDR13	MA20	MB20	MA60	2		.110 (2.8)	.110 (2.8)	.100 (2.5)	.015 (.4)	Palladium Silver
Pellet	—	MA21	MB21	MA61	2		.130 Max (3.3 Max)				Palladium Silver & Solder (SN62)
Micro-Strip	CDR21	MA22	MB22	MA62	2		.135 (3.4)				Silver Ribbon .093 (2.3) ± .005 (.1) Wide x .004 (.1) ± .001 (.03) Thick x .250 (6.35) Long (typical)
Radial Ribbon	CDR24	MA23	MB23	MA63	2		.135 (3.4)				
Radial Wire	CDR23**	MA24	MB24	MA64	2		.150 (3.8)				Silver Wire #26AWG .016 (.4) Dia. x .5 (12.7) Long (typical)
Axial Ribbon	CDR22	MA25	MB25	MA65	2		.135 (3.4)				Silver Ribbon .093 (2.3) ± .005 (.1) Wide x .004 (.1) ± .001 (.02) Thick x .250 (6.35) Long (typical)
Narrow Axial Ribbon	—	MA26	MB26	MA66	2		.135 (3.4)				Silver Ribbon .050 (1.25) ± .005 (.1) Wide x .004 (.1) ± .001 (.02) Thick x .250 (6.35) Long (typical)
Axial Wire	CDR25	MA27	MB27	MA67	2		.150 (3.8)				Silver Wire #26AWG .016 (.4) Dia. x .5 (12.7) Min. Long
Nickel Inter-Faced Pellet	CDR14	MA28	MB28	MA68	2		.130 Max. (3.3 Max)				Palladium Silver, Nickel Interface, Solder (SN62)

*Except where Tolerance is shown

**For CDR23, T and W dimensions are reversed

All leaded parts are bonded with high temperature solder (752°F/400°C)

MA10 & MA20 SERIES

P90 TC TO MIL-C-55681

This series is a dense packaged monolithic chip capacitor intended for application in higher frequencies up to gigahertz ranges. Material selection combined with carefully designed and monitored electrode construction produce parts with unusually low losses and high power handling capacity.

The MA10/20 group displays a very narrow spread thermal characteristic which is well within applicable MIL requirements.

This group meets or exceeds MIL-C-55681.

SPECIFICATIONS: MA10/20 SERIES

Capacitance Values:	Case Size "1": 0.3 to 100 pF Case Size "2": 0.3 to 1000pF
Quality Factor:	Exceeds MIL-C-55681 (See curve, Page 7)
Temperature Coefficient:	P90 ± 20 ppm/°C (–55°C to +125°C)
Insulation Resistance:	10 ⁶ Megohms at +25°C, 10 ⁵ Megohms at +125°C
Dielectric Test Voltage:	400% of WVDC for 5 seconds Case "1"; 250% of WVDC for 5 seconds Case "2"
Capacitance Drift:	Meets or exceeds MIL-C-55681
Microwave Performance:	"S" parameters - Data available on request.
Aging:	Negligible.
Capacitance Tolerance:	B = ± 0.1 pF C = ± 0.25 pF D = ± 0.5 pF F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$
Applicable MIL Specifications:	(1) MIL-C-55681 (2) MIL-C-11272
Environmental Test Specifications:	MIL-STD-202
Shock:	Method 213, Method J
Vibration:	Method 204, Condition B
Moisture Resistance:	Method 106
Solderability:	Method 208
Immersion:	Method 104, Condition B
Barometric Pressure:	Method 105, Condition B
Resistance to Soldering Heat:	Method 210, Condition B
Thermal Shock:	Method 107, Condition B
Life:	Method 108, Condition F
Dimensions and Termination Styles:	See Mechanical Configuration on Page 5
Marking:	All Case "2" capacitors may be laser marked with manufacturer's code, capacitance and tolerance. All Case "1" size capacitors may be laser marked with capacitance and tolerance.

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC) Case Size	
			1	2
OR3	0.3	BC	150	500
OR4	0.4	"	150	500
OR5	0.5	BCD	150	500
OR6	0.6	"	150	500
OR7	0.7	"	150	500
OR8	0.8	"	150	500
OR9	0.9	"	150	500
1R0	1.0	"	150	500
1R1	1.1	"	150	500
1R2	1.2	"	150	500
1R3	1.3	"	150	500
1R4	1.4	"	150	500
1R5	1.5	"	150	500
1R6	1.6	"	150	500
1R7	1.7	"	150	500
1R8	1.8	"	150	500
1R9	1.9	"	150	500
2R0	2.0	"	150	500
2R2	2.2	"	150	500
2R4	2.4	"	150	500
2R7	2.7	"	150	500
3R0	3.0	"	150	500
3R3	3.3	"	150	500
3R6	3.6	"	150	500
3R9	3.9	"	150	500
4R3	4.3	"	150	500
4R7	4.7	"	150	500
5R1	5.1	"	150	500
5R6	5.6	"	150	500
6R2	6.2	"	150	500

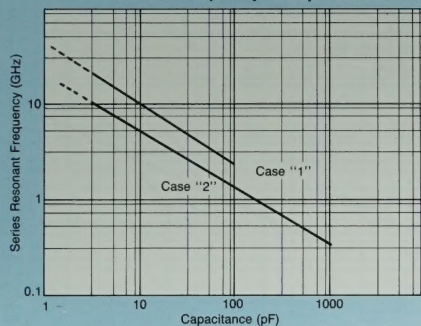
Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)** Case Size	
			1	2
6R8	6.8	BCJKM	150	500
7R5	7.5	"	150	500
8R2	8.2	"	150	500
9R1	9.1	"	150	500
100	10	FGJKM	150	500
110	11	"	150	500
120	12	"	150	500
130	13	"	150	500
150	15	"	150	500
160	16	"	150	500
180	18	"	150	500
200	20	"	150	500
220	22	"	150	500
240	24	"	150	500
270	27	"	150	500
300	30	"	150	500
330	33	"	150	500
360	36	"	150	500
390	39	"	150	500
430	43	"	150	500
470	47	"	150	500
510	51	"	150	500
560	56	"	150	500
620	62	"	150	500
680	68	"	150	500
750	75	"	150	500
820	82	"	150	500
910	91	"	150	500
101	100	"	150	500

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)** Case Size	
			1	2
111	110	FGJKM		300
121	120	"		300
131	130	"		300
151	150	"	*	300
161	160	"		300
181	180	"		300
201	200	"		300
221	220	FGJKM		200
241	240	"		200
271	270	"		200
301	300	"	*	200
331	330	"		200
361	360	"		200
391	390	"		200
431	430	"		200
471	470	"		200
511	510	FGJKM		100
561	560	"	*	100
621	620	"		100
681	680	FGJKM		50
751	750	"		50
821	820	"	*	50
911	910	"		50
102	1000	"		50

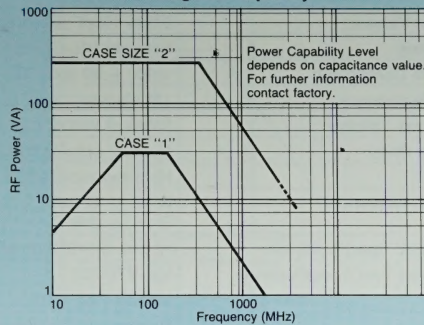
** @ 125°C

*Not available in this case size. ** @ 125°C

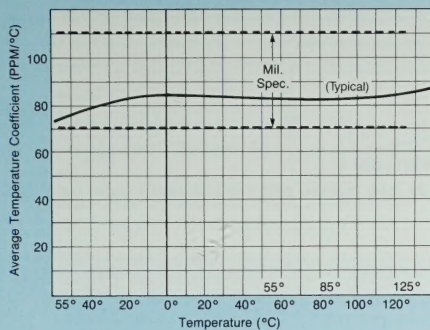
Series Resonant Frequency vs Capacitance



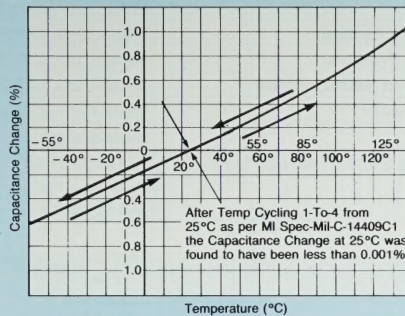
RF Power Rating vs Frequency



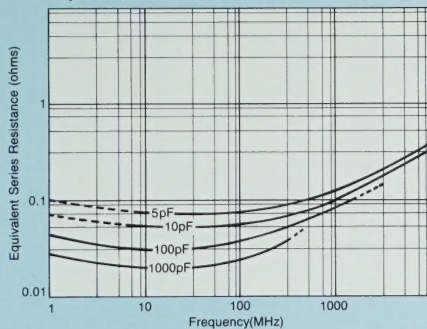
Temperature Coefficient vs Temperature



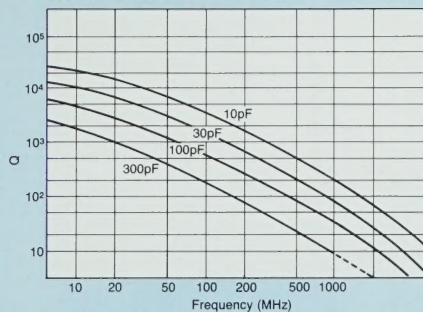
Capacitance Change vs Temperature



Equivalent Series Resistance vs Frequency



Typical Q vs Frequency



MB SERIES

MAGNA-Q

P90 TC TO MIL-C-55681

The MB Series has been primarily designed for higher current and frequency applications up to 175°C without derating. Through this ad-

vanced design, circuit losses have been substantially reduced due to the higher Q of the components.

SPECIFICATIONS

Capacitance Values:	0.3 to 100pF (Case Size "2" only)			
Quality Factor:	Exceeds MIL-C-55681 (see curve page 9)			
Temperature Coefficient:	+90, \pm 30 ppm/°C (-55 to 175°C)			
Insulation Resistance:	10 ⁵ Megohms min. at 175°C			
Dielectric Test Voltage:	250% of WVDC for 5 seconds			
Capacitance Drift:	Meets or exceeds MIL-C-55681			
Aging:	No measurable effect			
Capacitance Tolerance:	B = \pm 0.1pF G = \pm 2%	C = \pm 0.25pF J = \pm 5%	D = \pm 0.5pF K = \pm 10%	F = \pm 1% M = \pm 20%
Applicable MIL Specifications:	(1) MIL-C-11272 (2) MIL-C-55681			
Environmental Test Specifications:	MIL-STD-202			
Shock:	Method 213, Method J			
Vibration:	Method 204, Condition B			
Moisture Resistance:	Method 106			
Solderability:	Method 208			
Immersion:	Method 104, Condition B			
Temperature Cycling:	Method 102, Condition C			
Barometric Pressure:	Method 105, Condition B			
Resistance to Soldering Heat:	Method 210, Condition B			
Thermal Shock:	Method 107, Condition B			
Life:	Method 108, Condition F			
Dimensions and Termination Styles:	See mechanical configurations on page 5			
Marking:	Case Size "2" capacitor may be laser marked with manufacturer's code, capacitance and tolerance.			

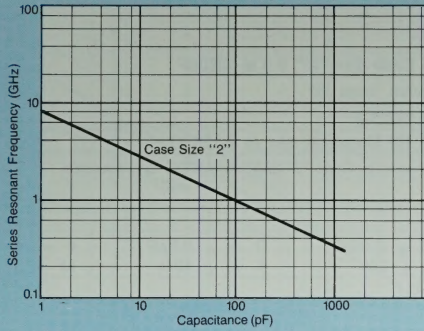
Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Size 2
OR3	0.3	BC	1000
OR4	0.4	"	1000
OR5	0.5	BCD	1000
OR6	0.6	"	1000
OR7	0.7	"	1000
OR8	0.8	"	1000
OR9	0.9	"	1000
1R0	1.0	"	1000
1R1	1.1	"	1000
1R2	1.2	"	1000
1R3	1.3	"	1000
1R4	1.4	"	1000
1R5	1.5	"	1000
1R6	1.6	"	1000
1R7	1.7	"	1000
1R8	1.8	"	1000
1R9	1.9	"	1000
2R0	2.0	"	1000
2R2	2.2	"	1000
2R4	2.4	"	1000
2R7	2.7	"	1000
3R0	3.0	"	1000
3R3	3.3	"	1000
3R6	3.6	"	1000
3R9	3.9	"	1000
4R3	4.3	"	1000
4R7	4.7	"	1000
5R1	5.1	"	1000
5R6	5.6	"	1000
6R2	6.2	"	1000

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Size 2
6R8	6.8	BCJKM	1000
7R5	7.5	"	1000
8R2	8.2	"	1000
9R1	9.1	"	1000
100	10.0	FGJKM	1000
110	11.0	"	500
120	12.0	"	500
130	13.0	"	500
150	15.0	"	500
160	16.0	"	500
180	18.0	"	500
200	20.0	"	500
220	22.0	"	500
240	24.0	"	500
270	27.0	"	500
300	30.0	"	500
330	33.0	"	500
360	36.0	"	500
390	39.0	"	500
430	43.0	"	500
470	47.0	"	300
510	51.0	"	300
560	56.0	"	300
620	62.0	"	300
680	68.0	"	100
750	75.0	"	100
820	82.0	"	100
910	91.0	"	100
101	100.0	"	100

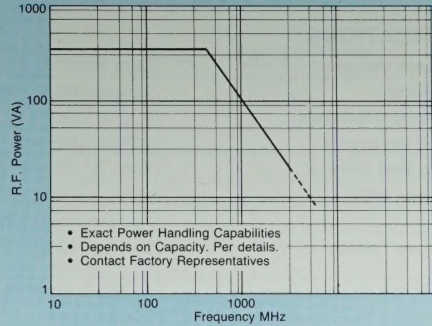
*@175°C

*@175°C

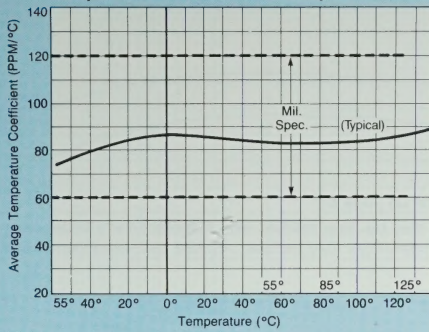
Series Resonant Frequency vs Capacitance



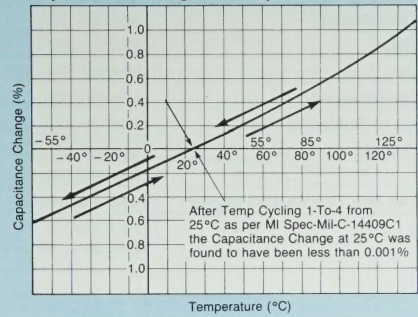
RF Power Rating vs Frequency



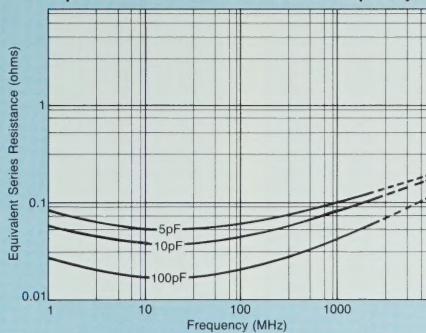
Temperature Coefficient vs Temperature



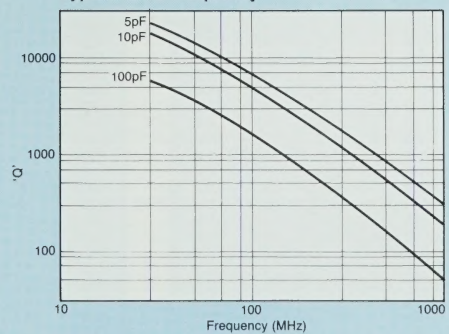
Capacitance Change vs Temperature



Equivalent Series Resistance vs Frequency



Typical Q vs Frequency



MA50 & MA60 SERIES

NPO TC TO MIL-C-55681

Like the MA10/20 series, this series is an extremely high density, high performance type which features an NPO temperature coefficient and very high Q factor. Long term capacity (dielectric) drift and aging are negligible and the voltage coefficient of the assembly is zero.

SPECIFICATIONS

Capacitance Values:	Case Size "1": 0.3 to 330 pF Case Size "2": 0.3 to 2200pF			
Quality Factor:	Exceeds MIL-C-55681 (See curve, page 11)			
Temperature Coefficient:	0 \pm 30 ppm/ $^{\circ}$ C (–55 $^{\circ}$ C to +125 $^{\circ}$ C)			
Insulation Resistance:	10 ⁶ Megohms min. at +25 $^{\circ}$ C 10 ⁵ Megohms min. at +125 $^{\circ}$ C			
Dielectric Test Voltage:	Case "1" 270% of WVDC for 5 seconds; Case "2" 250% of WVDC for 5 seconds			
Capacitance Drift:	Meets or exceeds MIL-C-55681			
Aging:	No measurable effect			
Capacitance Tolerance:	B = \pm 0.1pF G = \pm 2%	C = \pm 0.25pF J = \pm 5%	D = \pm 0.5pF K = \pm 10%	F = \pm 1% M = \pm 20%
Applicable MIL Specifications:	(1) MIL-C-11272 (2) MIL-C-55681			
Environmental Test Specifications:	MIL-STD-202			
Shock:	Method 213, Condition J			
Vibration:	Method 204, Condition B			
Temperature Cycling:	Method 102, Condition C			
Moisture Resistance:	Method 106			
Solderability:	Method 208			
Immersion:	Method 104, Condition B			
Barometric Pressure:	Method 105, Condition B			
Resistance to Soldering Heat:	Method 210, Condition B			
Thermal Shock:	Method 107, Condition B			
Life:	Method 108, Condition F			
Dimensions and Termination Styles:	See mechanical configurations on page 5			
Marking:	All Case "2" size capacitors may be laser marked with manufacturer's code, capacitance and tolerance. All Case "1" size capacitors may be laser marked with capacitance and tolerance.			

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC) Case Size	
			1	2
OR3	0.3	BC	150	500
OR4	0.4	"	150	500
OR5	0.5	"	150	500
OR6	0.6	"	150	500
OR7	0.7	"	150	500
OR8	0.8	"	150	500
OR9	0.9	"	150	500
1R0	1.0	"	150	500
1R1	1.1	"	150	500
1R2	1.2	"	150	500
1R3	1.3	"	150	500
1R4	1.4	"	150	500
1R5	1.5	"	150	500
1R6	1.6	"	150	500
1R7	1.7	"	150	500
1R8	1.8	"	150	500
1R9	1.9	"	150	500
2R0	2.0	"	150	500
2R2	2.2	"	150	500
2R4	2.4	"	150	500
2R7	2.7	"	150	500
3R0	3.0	"	150	500
3R3	3.3	"	150	500
3R6	3.6	"	150	500
3R9	3.9	"	150	500
4R3	4.3	"	150	500
4R7	4.7	"	150	500
5R1	5.1	"	150	500
5R6	5.6	"	150	500
6R2	6.2	"	150	500
6R8	6.8	BCJKM	150	500
7R5	7.5	"	150	500
8R2	8.2	"	150	500
9R1	9.1	"	150	500

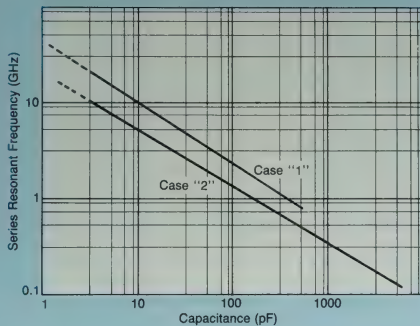
Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Case Size	
			1	2
100	10.0	FGJKM	150	500
110	11.0	"	150	500
120	12.0	"	150	500
130	13.0	"	150	500
150	15.0	"	150	500
160	16.0	"	150	500
180	18.0	"	150	500
200	20.0	"	150	500
220	22.0	"	150	500
240	24.0	"	150	500
270	27.0	"	150	500
300	30.0	"	150	500
330	33	"	150	500
360	36	"	150	500
390	39	"	150	500
430	43	"	150	500
470	47	"	150	500
510	51	"	150	500
560	56	"	150	500
620	62	"	150	500
680	68	"	150	500
750	75	"	150	500
820	82	"	150	500
910	91	"	150	500
101	100	"	150	500
111	110	"	150	300
121	120	"	150	300
131	130	"	150	300
151	150	"	150	300
161	160	"	150	300
181	180	"	150	300
201	200	"	150	300
221	220	"	150	200

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Case Size	
			1	2
241	240	FGJKM	150	200
271	270	"	150	200
301	300	"	150	200
331	330	"	150	200
361	360	"	150	200
391	390	"	150	200
431	430	"	150	200
471	470	"	150	200
511	510	"	150	100
561	560	"	150	100
621	620	"	150	100
681	680	"	150	50
751	750	"	150	50
821	820	"	150	50
911	910	"	150	50
102	1000	"	150	50
112	1100	"		50
122	1200	"		50
132	1300	"		50
152	1500	"		50
182	1800	"		50
202	2000	"		50
222	2200	"		50
242	2400	"		50
272	2700	"		50
302	3000	"		50
332	3300	"		50
362	3600	"		50
392	3900	"		50
432	4300	"		50
472	4700	"		50
512	5100	"		50

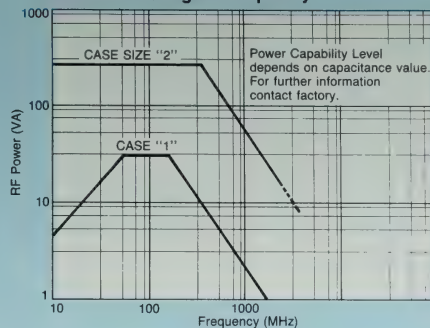
* @ 125 $^{\circ}$ C

* @ 125 $^{\circ}$ C

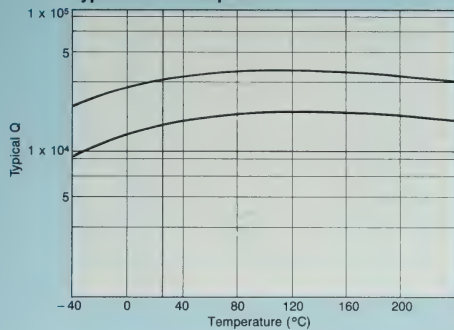
Series Resonant Frequency vs Capacitance



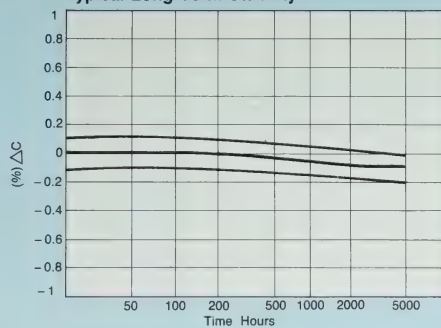
RF Power Rating vs Frequency



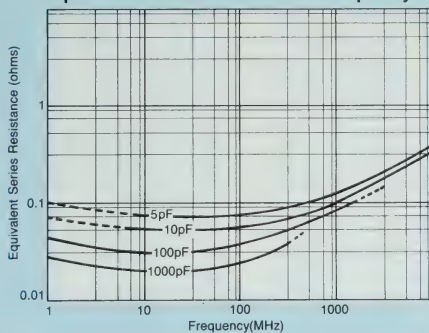
Typical Q vs. Temperature



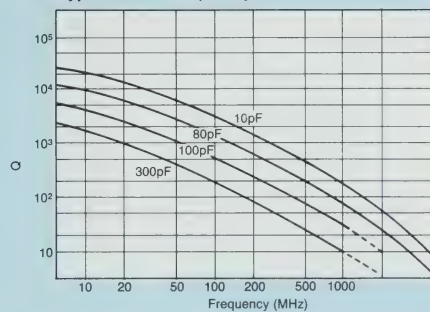
Typical Long Term Stability



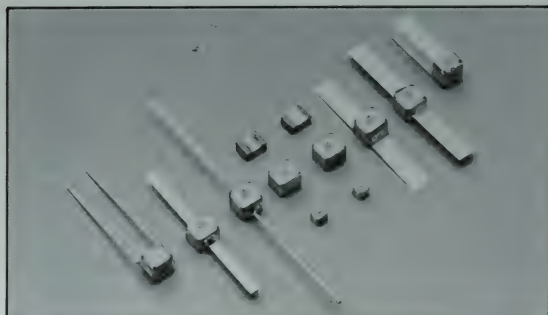
Equivalent Series Resistance vs Frequency



Typical Q vs Frequency



X7R TC TO MIL-C-55681 (where applicable)



The MA 70/80 Series fixed ceramic capacitors offers the highest capacitance values per unit of volume of all MA Series components.

It is designed and manufactured to the same stringent requirements for performance and reliability as all of the other capacitors in the MA Series.

SPECIFICATIONS

Capacitance Values:	Case 1 - 510pF to 10,000-pF Case 2 - 5000pF to 100,000pF
Temperature Coefficient:	± 15% maximum (– 55°C to + 125°C)
Working Voltage:	Case Size 1 - 50WVDC Case Size 2 - 100WVDC
Dissipation Factor:	2.5% maximum @ 1.0 VRMS maximum (f = 1 KHz)
Insulation Resistance:	10 ⁵ megohms or 1000 megohms uF minimum, whichever is less (@ 25°C) 10 ⁴ megohms or 100 megohms uF minimum, whichever is less (@ 125°C)
Dielectric Test Voltage:	300% of WVDC for 5 seconds
Capacitance Tolerance:	K = ± 10% M = ± 20% Z = + 80% – 20%
Applicable MIL Specifications:	(1) MIL-C-55681
Environmental Specifications:	MIL-STD-202
Shock:	Method 213, Condition J
Vibration:	Method 204, Condition B
Solderability:	Method 208
Barometric Pressure:	Method 105, Condition B
Dimension Termination Styles:	See drawings on page 13
Recommended Testing Sequence:	Refer to MIL-C-55681
Marking:	Consult factory for marking details

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Case Size	
			1	2
511	510	K,M,Z	50	
561	560	K,M,Z	50	
621	620	K,M,Z	50	
681	680	K,M,Z	50	
751	750	K,M,Z	50	
821	820	K,M,Z	50	
911	910	K,M,Z	50	
102	1000	K,M,Z	50	
112	1100	K,M,Z	50	
122	1200	K,M,Z	50	
132	1300	K,M,Z	50	
152	1500	K,M,Z	50	
162	1600	K,M,Z	50	
182	1800	K,M,Z	50	
202	2000	K,M,Z	50	
222	2200	K,M,Z	50	
242	2400	K,M,Z	50	
272	2700	K,M,Z	50	
302	3000	K,M,Z	50	

Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Case Size	
			1	2
332	3300	K,M,Z	50	
362	3600	K,M,Z	50	
392	3900	K,M,Z	50	
432	4300	K,M,Z	50	
472	4700	K,M,Z	50	
512	5100	K,M,Z	50	100
562	5600	K,M,Z	50	100
622	6200	K,M,Z	50	100
682	6800	K,M,Z	50	100
752	7500	K,M,Z	50	100
822	8200	K,M,Z	50	100
912	9100	K,M,Z	50	100
103	10000	K,M,Z	50	100
113	11000	K,M,Z		100
123	12000	K,M,Z		100
133	13000	K,M,Z		100
153	15000	K,M,Z		100
163	16000	K,M,Z		100
183	18000	K,M,Z		100





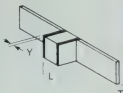






Cap. Code	Cap. (pF)	Cap. Tol.	(WVDC)* Case Size	
			1	2
203	20000	K,M,Z		100
223	22000	K,M,Z		100
243	24000	K,M,Z		100
273	27000	K,M,Z		100
303	30000	K,M,Z		100
333	33000	K,M,Z		100
363	36000	K,M,Z		100
393	39000	K,M,Z		100
433	43000	K,M,Z		100
473	47000	K,M,Z	**	100
513	51000	K,M,Z		100
563	56000	K,M,Z		100
623	62000	K,M,Z		100
683	68000	K,M,Z		100
753	75000	K,M,Z		100
823	82000	K,M,Z		100
913	91000	K,M,Z		100
104	100000	K,M,Z		100

*K Tolerance ($\pm 10\%$) available on special order

All leaded parts are bonded with high temperature solder (752°F/400°C)

* @85°C

** Not available in this case size.

				DIMENSIONS: in. (mm)			BAND	DESCRIPTION
Style	Type	Case Size	Configuration	$L \pm .015^*$ (.4)	$W \pm .015^*$ (.4)	Tmax	$Y \pm .010$ (.25)	Terminations
Chip	MA70	1		$.055(1.4) \pm .01(.25)$	$.055(1.4) \pm .010(.25)$	$.065(1.65)$	$.010(.25) \pm .005(.1)$	Palladium Silver
Pellet	MA71	1		$.070 \text{ Max}$ (1.8) Max				Palladium Silver & Solder (SN62)
Nickel Interfaced Pellet	MA78	1						Palladium Silver, Nickel Interface, Solder (SN62)
Chip	MA80	2		$.110(2.8)$	$.110(2.8)$	$.115(2.9)$	$.015(.3) \pm .010(.25)$	Palladium Silver
Pellet	MA81	2		$.130 \text{ Max}$ (3.3) Max				Palladium Silver & Solder (SN62)
Pellet Microstrip	MA82	2		$.135(3.4)$				Silver Ribbon $.093(2.3) \pm .005(.1)$ Wide x $.004(.1) \pm .001(.03)$ Thick x $.250(6.35)$ Long (typical)
Radial Ribbon	MA83	2						
Radial Wire	MA84	2						Silver Wire #26 AWG .016(.4) Dia x .5(12.7) Long (typical)
Axial Ribbon	MA85	2						Silver Ribbon $.093(2.3) \pm .005(.1)$ Wide x $.004(.1) \pm .001(.02)$ Thick x $.250(6.35)$ Long (typical)
Narrow Axial Ribbon	MA86	2						Silver Ribbon $.050(1.25) \pm .005(.1)$ Wide x $.004(.1) \pm .001(.02)$ Thick x $.250(6.35)$ Long (typical)
Axial Wire	MA87	2						Silver Wire #26 AWG .016(.4) Dia. x .5(12.7) Min. Long
Nickel Interfaced Pellet	MA88	2		$.130 \text{ Max}$ (3.3)				Palladium Silver, Nickel Interface, Solder (SN62)

*Except where tolerance shown

All leaded parts are bonded with high temperature solder (752°F/400°C)

MURATA ERIE

FIXED CAPACITOR

GENERAL TEST PROCEDURES

VOLTAGE CONDITIONING: Twice rated voltage (DC) shall be applied for 100 hours at maximum rated-temperatures. After return to room temperature, the Q, or Q.F. and the Dielectric withstanding voltage is checked to specification. The test sample is then restabilized at maximum rated temperature, and the I.R. is checked to specification. The sample is then restabilized at room temperature, and the capacitance, Dissipation Factor, and I.R. is checked to specification. (Note: For X7R material, a period of up to 24 hours may be permitted before final room temperature measurements).

DIELECTRIC WITHSTANDING VOLTS (DWV): Unless otherwise specified, 250% of rated voltage (DC) is applied between the capacitor terminals for a period of 5 ± 1 second with a surge current limitation of 50 mA. There shall be no evidence of voltage breakdown or mechanical damage to the assembly.

INSULATION RESISTANCE (I.R.): Insulation Resistance is tested at rated DC voltage using a series resistor such as to limit charging current to 50 mA. Note: All test capacitors must be cleaned of fingerprints or other contamination before this procedure, and the test is restricted to atmospheric relative humidities of 50% or less.

CAPACITANCE: Capacity measurements shall be made at $1 \pm .2$ volts and a frequency of $1 \text{ MHz} \pm .05\%$ for all capacitors with P90 material. For NPO material over 100 pF, the measuring frequency shall be $1 \text{ KHz} \pm 50\text{Hz}$. All X7R capacitors shall be measured at 1 KHz.

DISSIPATION FACTOR (DF): The DF shall be measured on the same instrument and the same frequencies which are used for the capacity measurements where applicable.

QUALITY FACTOR (Q): Cap. Value less than 200pF, Q measured at 10 MHz meets MIL-C-55681. Cap. Value greater than 200pF, Q measured at 1 MHz greater than 10,000. For MA10/20, MB20, MA50/60 Series only. See below test set-up.

SOLDERABILITY: Capacitors shall be tested using Methods 208 of MIL-STD-202 as follows — leadless assemblies shall be immersed to a depth of $-.020 + .010, -.000$; leaded assemblies shall be immersed to a distance of $0.030 \pm .020$ of the capacitor body. Specified solder shall be SN62 and immersed surface shall be 95% covered with no solder void concentration. The solder pot temperature shall be $230, \pm 5^\circ\text{C}$.

LIFE (at max. rated temperature): Capacitors shall be mounted in a special manner and placed in a 125°C environment with 200% rated voltage applied for a total of 2,000 hours. Insulation Resistance shall be measured after 1,000 and 2,000 hours at the 125°C temperature. The assemblies shall then be restabilized at room temperature and retested for mechanical damage, capacitance, dissipation factor, and insulation resistance in the normal manner.

RESONANCE: Unless otherwise specified, the test assemblies shall be mounted as illustrated in MIL-C-55681. (Par.4.7.16) and searched between the fre-

quencies of 100 to 10,000 MHz in a smooth progression using an impedance plotter to find the lowest self-resonant frequency.

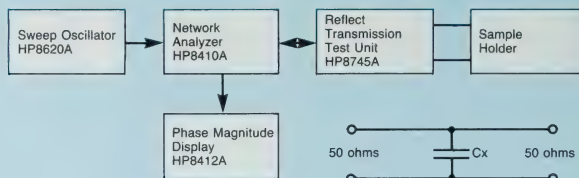
VOLTAGE TEMPERATURE CHARACTERISTICS: Capacitors shall be tested as shown in the table with the capacitance value obtained in step C considered as the reference point. Capacitors shall be kept at each temperature until a temperature equilibrium is obtained. This measurement will be performed only on capacitor values of 10pF or over. Smaller valued capacitors shall be characterized as having the same voltage temperature limits as those of 10pF or more which are manufactured in the same lot.

STEP	Voltage, DC	Temp. °C
A	None	$+25 \pm 2$
B	None	-75 ± 2
C (Ref. Pt.)	None	$+25 \pm 2$
D	None	Max. Rated Temp. $+4$
E	Rated Voltage	$+25 \pm 2$
F	Rated Voltage	$+25 \pm 2$
G	Rated Voltage	-55 ± 2

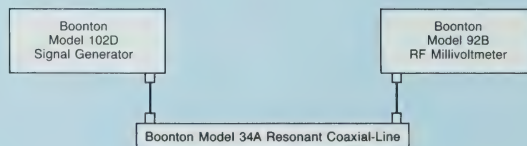
RESISTANCE TO SOLDER HEAT TEST: Capacitors shall be tested using Method 210 of MIL-STD-202. (procedure 2, condition B-i.e., 250°C for 10 seconds). There shall be no mechanical damage, loosening of terminals or indications of rupture. (Use Ni-Interface pellets for additional leach resistance.)

SPECIAL PROCEDURES

1. Equivalent Series Resistance Measurement



2. Self Resonant Frequency Measurement



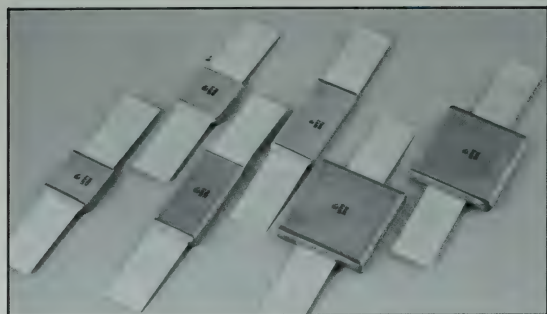
MURATA ERIE P/N	ATC P/N
SERIES: P90 ± 20 PPM/°C	
MA 10 _____	ATC100A ---- C --
MA 18 _____	ATC100A ---- P --
MA 20 _____	ATC100B ---- C --
MA 22 _____	ATC100B ---- MS --
MA 23 _____	ATC100B ---- RR --
MA 24 _____	ATC100B ---- RW --
MA 25 _____	ATC100B ---- AR --
MA 26 _____	ATC100B ---- NAR --
MA 27 _____	ATC100B ---- AW --
MA 28 _____	ATC100B ---- P --
NON STANDARD (ON REQUEST)	ATC100B ---- VNMS --
NON STANDARD (ON REQUEST)	ATC100B ---- NMS --
SERIES: P90 ± 30PPM/°C	
MB 20 _____	ATC175B ---- C --
MB 22 _____	ATC175B ---- MS --
MB 23 _____	ATC175B ---- RR --
MB 24 _____	ATC175B ---- RW --
MB 25 _____	ATC175B ---- AR --
MB 26 _____	ATC175B ---- NAR --
MB 27 _____	ATC175B ---- AW --
MB 28 _____	ATC175B ---- P --
NON STANDARD (ON REQUEST)	ATC175B ---- VNMS --
NON STANDARD (ON REQUEST)	ATC175B ---- NMS --

MURATA ERIE P/N	ATC P/N
SERIES: 0 ± 30PPM/°C	
MA 50 _____	ATC700A ---- C --
MA 58 _____	ATC700A ---- P --
MA 60 _____	ATC700B ---- C --
MA 62 _____	ATC700B ---- MS --
MA 63 _____	ATC700B ---- RR --
MA 64 _____	ATC700B ---- RW --
MA 65 _____	ATC700B ---- AR --
MA 66 _____	ATC700B ---- NAR --
MA 67 _____	ATC700B ---- AW --
MA 68 _____	ATC700B ---- P --
NON STANDARD (ON REQUEST)	ATC700B ---- VNMS --
NON STANDARD (ON REQUEST)	ATC700B ---- NMS --
SERIES: X7R	
MA 70 _____	ATC200A ---- C --
MA 78 _____	ATC200A ---- P --
MA 80 _____	ATC200B ---- C --
MA 82 _____	ATC200B ---- MS --
MA 83 _____	ATC200B ---- RR --
MA 84 _____	ATC200B ---- RW --
MA 85 _____	ATC200B ---- AR --
MA 86 _____	ATC200B ---- NAR --
MA 87 _____	ATC200B ---- AW --
MA 88 _____	ATC200B ---- P ----
NON STANDARD (ON REQUEST)	ATC200B ---- VNMS --
NON STANDARD (ON REQUEST)	ATC200B ---- NMS --

EXAMPLE

MA 10 101J = ATC100A 101JC50

MINIATURE RF POWER GLASS ENCAPSULATED MULTILAYER CAPACITORS



Miniature UFP fixed ceramic capacitors are specifically designed for high voltage and high RF current microwave applications. They are ideally suited to the latest aerospace and commercial mobile and fixed communication equipment.

Glass encapsulation protects UFP capacitors against corona, contaminants and other environmental factors. Wide, fine silver lead terminations assure minimum inductance and high RF current capabilities. They can withstand temperatures far in excess of soldered units due to solderless lead attachment.

SPECIFICATIONS

Current: 8 amperes at 25°C (Derated for higher temperatures)
Q: 5,000 min at 1 MHz and 25°C for values 1,000pF and smaller
Tolerances: ± 0.5pF for values below 10pF
 ± 5%, ± 10% for higher values

Power: 12 KVAR at 25°C typical
Voltage: See chart below
***Temperature Coefficient:** + 90, ± 20ppm/°C at 1 MHz
 (– 55°C to + 125°C)
Testing: RF tested to rated specifications
Marking: All capacitors stamp marked with company I.D., cap. code and tolerance

*NPO T.C. also available. Consult factory.

MODELS	RANGE OF VALUES (pF)	WVDC	TEST VOLTAGE DC	RF CURRENT AMPS. RMS at +25°C	RF VOLTAGE RMS at +25°C	KVAR* RATING at +25°C	VOLTAGE LIMITING IMPEDANCE (OHMS)	CURRENT LIMITING IMPEDANCE (OHMS)
UFP1	10 to 150	3,600	7,000	8	3,000	12	750	187.5
	160 to 330	2,500	4,500	8	2,000	12	333.3	187.5
	360 to 620	1,200	2,400	8	1,000	6	166.7	93.75
	680 to 1,300	600	1,200	8	500	3	83.3	46.88
	1,500 to 3,000	300	600	8	250	1.5	41.67	23.44
UFP2	10 to 75	5,400	10,000	8	5,000	18	1,390	281
UFP3	82 to 150	5,400	10,000	8	5,000	18	1,390	281
	160 to 330	3,600	7,000	8	3,000	18	500	281
	360 to 620	2,500	4,500	8	2,000	12	333.3	187.5

*NOTE

- When the impedance of the capacitor is higher than the value shown the limiting factor is the RF voltage shown.
- When the impedance of the capacitor is below the value shown, the limiting factor is the RF current shown.
- Between these two impedance limits, the KVAR rating is the limiting factor. Formulas for voltage and current are:

$$V = (1,000 \times \text{KVAR} \times \text{IMPEDANCE})^{1/2} \quad I = \left(\frac{1,000 \times \text{KVAR}}{\text{IMPEDANCE}} \right)^{1/2}$$

- RF current rating derates .4%/°C from +25°C rating at all higher temperatures to +125°C
- KVAR rating derates .5%/°C from +25°C rating at all higher temperatures to +125°C.
- RF voltage derates .16%/°C from +25°C rating at all higher temperatures to +125°C.

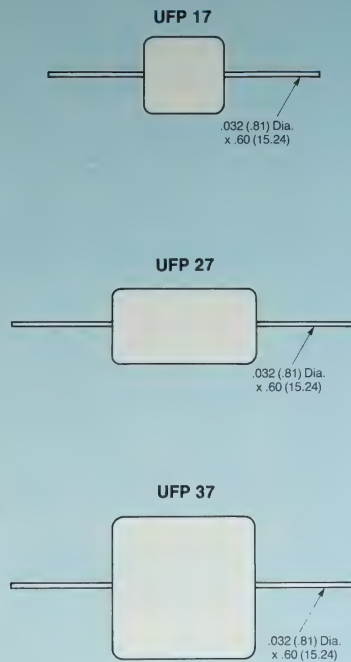
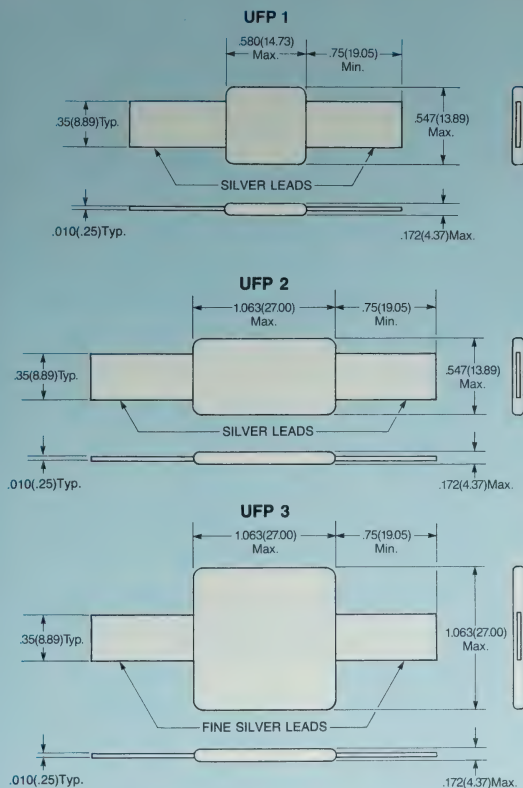
CAPACITY VALUES (pF) & TOLERANCES

UFP1					UFP2		UFP3		NOTE
10	33	100	330	1,000	10	33	82	240	All values are available in ±5% and ±10% tolerances.
11	36	110	360	1,100	11	36	91	270	
12	39	120	390	1,200	12	39	100	300	
13	43	130	430	1,300	13	43	110	330	All values are available in UFP1 model.
15	47	150	470	1,500	15	47	120	360	
16	51	160	510	1,600	16	51	130	390	
18	56	180	560	1,800	18	56	150	430	Values up to and including 75 pF are available in UFP2 model.
20	62	200	620	2,000	20	62	160	470	
22	68	220	680	2,200	22	68	180	510	
24	75	240	750	2,400	24	75	200	560	Values 82 pF and above, are available in UFP3 model.
27	82	270	820	2,700	27		220	620	
30	91	300	910	3,000	30				

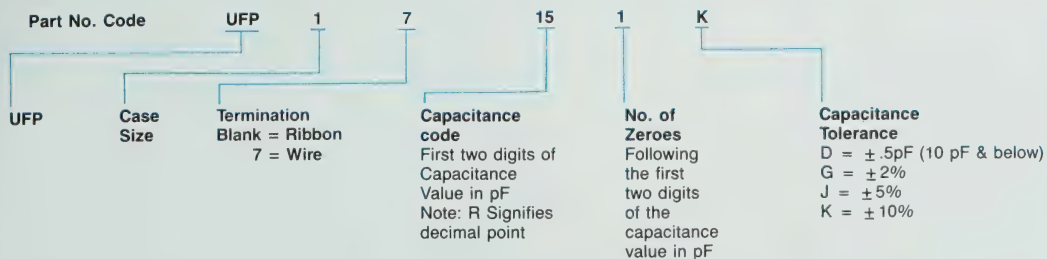
Values below 10 pF are available as specials in UFP2 model (D tolerance, only).

MINIATURE RF POWER GLASS ENCAPSULATED MULTILAYER CAPACITORS

DIMENSIONS: in. (mm)

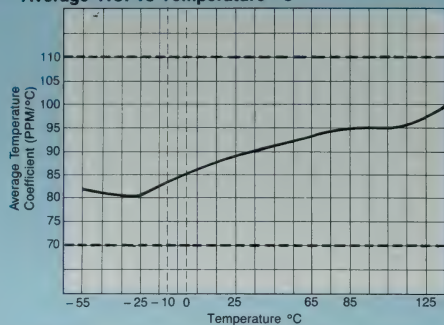


UFP ORDERING INFORMATION

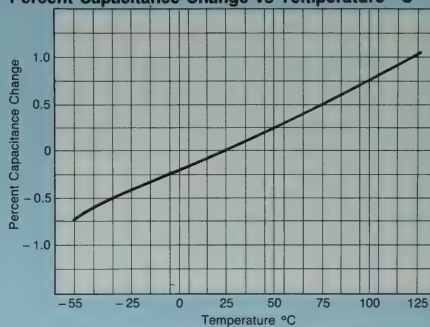


MINIATURE RF POWER GLASS ENCAPSULATED MULTILAYER CAPACITORS UFP SERIES TYPICAL PERFORMANCE

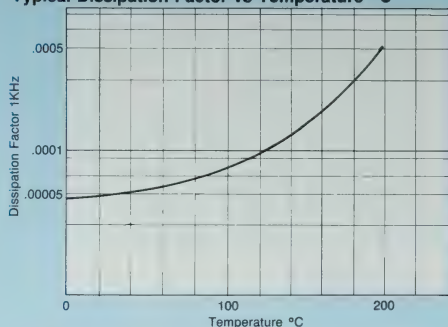
Average T.C. vs Temperature °C



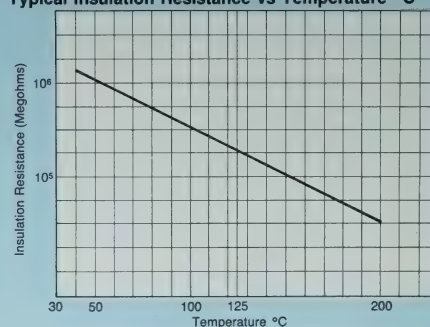
Percent Capacitance Change vs Temperature °C



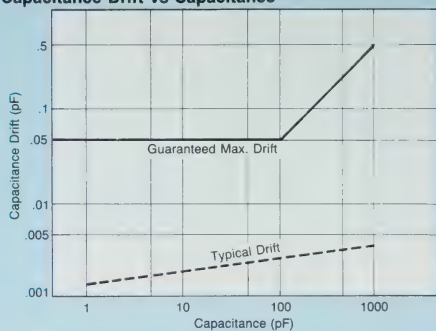
Typical Dissipation Factor vs Temperature °C



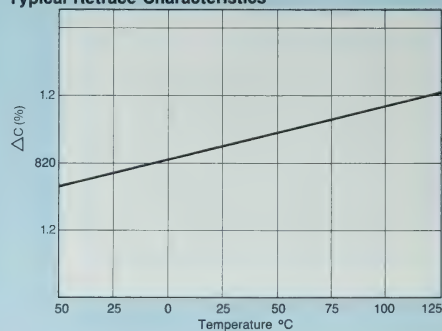
Typical Insulation Resistance vs Temperature °C



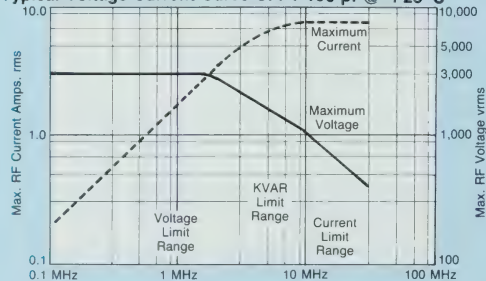
Capacitance Drift vs Capacitance



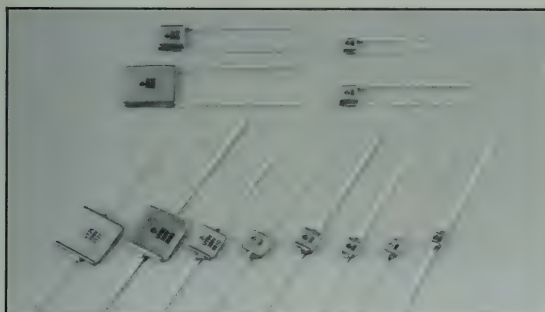
Typical Retrace Characteristics



Typical Voltage-Current Curve UFP1 100 pf @ +25°C



UNICERAM HIGH-Q UY SERIES MINIATURE CERAMIC CAPACITORS



SPECIFICATIONS

Operating Temperature range	- 55 to + 125°C
Temperature Coefficient	+ 90 ± 20 ppm/°C
Working Voltage	See Table
Dielectric Test Voltage	200% of rated working voltage
Capacitance Value	Measured at 1 MHz and 1 V.rms
Capacitance Tolerance	See Table
Quality Factor (Q)	for values 1000pF and smaller 5000 Min. @ 1 MHz
Dissipation Factor	for values above 1000pF .0002 Max.
Insulation Resistance	@ 25°C : 10 ⁹ Megohms Min. @ 125°C : 10 ⁶ Megohms Min. or 500 ohm farads whichever is less
Marking:	All capacitors are stamp marked with Co. I.D., Cap. Code and Tolerance

Unicram High Q ceramic fixed capacitors offer the *highest available* Q — a minimum of 5,000 @ 1 MHz. Typical Q's are greater than 10,000 over catalog capacitance range.

Precise ceramic dielectric layers are fused into a solid monolithic structure. Silver leads are bonded to the capacitor by a unique solderless process. As a result, Unicram High Q capacitors maintain stability despite extreme voltage and frequency variations, and severe environmental ambients. Their proprietary ceramic monolithic construction also yields high power handling capabilities per unit volume as well as the ability to operate at an ambient temperature well in excess of the melting point of solder.

Unicram High Q capacitor can be provided with radial wire, axial ribbon or axial wire leads. They are also available as unencapsulated chips. These units are ideal for applications where low inductance is essential.

FEATURES

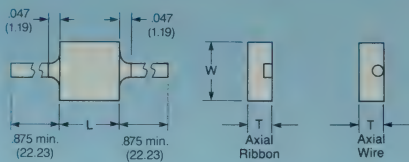
- Meets MIL-C-11272 and MIL-C-23269 applicable requirements regarding shock, vibration, hermeticity, temperature cycling, solder immersion and salt spray.
- High capacitance per unit volume.
- Available in five sizes covering 0.5 pF to 3000 pF.
- Other ceramic materials, metalizing bands, form factors and voltages available on special order.
- Designed for direct connection to microwave substrates, headers, printed circuit boards and hybrid circuits.

PART NO.	CAP. CODE	CAP. (pF)	CAP. TOLERANCE							WVDC @ 125°C	
			C	D	F	G	J	K		200	300
WY01 UY01 UY21	0R5	0.5									
	1R0	1.0									
	1R5	1.5									
	2R2	2.2									
	2R7	2.7									
	3R0	3.0									
	3R3	3.3									
	3R6	3.6									
	3R9	3.9									
WY01 WY02 UY01 UY02 UY21 UY22 UY62	4R3	4.3									
	4R7	4.7									
	5R1	5.1									
	5R6	5.6									
	6R2	6.2									
	6R8	6.8									
	7R5	7.5									
	8R2	8.2									
	9R1	9.1									
	100	10									
	110	11									
	120	12									
	130	13									
	150	15									
	160	16									
	180	18									
	200	20									
	220	22									
	240	24									
	270	27									
	300	30									
	330	33									
	360	36									
	390	39									
	430	43									
	470	47									
	510	51									
	560	56									
	620	62									

PART NO.	CAP. CODE	CAP. (pF)	CAP. TOLERANCE							WVDC @ 125°C	
			C	D	F	G	J	K		200	300
WY02 UY02 UY22 UY62	680	68									
	750	75									
	820	82									
	910	91									
	101	100									
	111	110									
	121	120									
	131	130									
	151	150									
	161	160									
	181	180									
	201	200									
WY03 UY03 UY23 UY63	221	220									
	241	240									
	271	270									
	301	300									
	331	330									
	361	360									
	391	390									
	431	430									
	471	470									
	511	510									
	561	560									
	621	620									
WY04 UY04 UY24 UY64	681	680									
	751	750									
	821	820									
	911	910									
	102	1000									
	112	1100									
	122	1200									
	132	1300									
	152	1500									
	162	1600									
	182	1800									
	202	2000									
WY05 UY05 UY25 UY65	222	2200									
	242	2400									
	272	2700									
	302	3000									

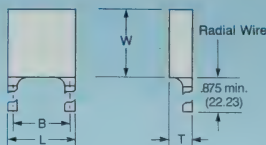
UNICERAM HIGH-Q (UY) MINIATURE CERAMIC CAPACITORS

DIMENSIONS: in. (mm)



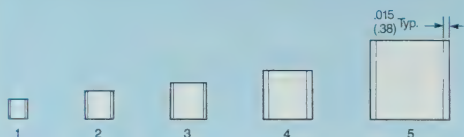
MODEL		L & W ±.031 (.78)	T ±.031 (.78)	Lead Size*	
Axial Ribbon	Axial Wire			Wire ±.003 (.08)	Ribbon
UY01	UY21	.109 (2.77)	.062 (1.57)	.023 (.58)	.050 (1.27) x .010 (.25)
UY02	UY22	.140 (3.56)	.062 (1.57)	.023 (.58)	.050 (1.27) x .010 (.25)
UY03	UY23	.187 (4.75)	.078 (1.98)	.023 (.58)	.050 (1.27) x .010 (.25)
UY04	UY24	.250 (6.35)	.078 (1.98)	.023 (.58)	.050 (1.27) x .010 (.25)
UY05	UY25	.406 (10.31)	.078 (1.98)	.023 (.58)	.050 (1.27) x .010 (.25)

UY21 size is available on special order only.



MODEL	L & W ±.031 (.78)	T ±.031 (.78)	B-Lead Spacing ±.031 (.78)	Lead Size ±.003 (.08)
UY62	.140 (3.55)	.062 (1.57)	.123 (3.12)	.023 (.58)
UY63	.187 (4.75)	.078 (1.98)	.175 (4.45)	.023 (.58)
UY64	.250 (6.35)	.078 (1.98)	.225 (5.72)	.023 (.58)
UY65	.406 (10.3)	.078 (1.98)	.375 (9.53)	.023 (.58)

ACTUAL CASE SIZE



MODEL	MAX. CAP. (pF)		L ±.015 (.38)	W (max.)	T (max.)
	300 VDC	Other			
WY01	62	Voltagages Available	.109 (2.77)	.115 (2.92)	.060 (1.52)
WY02	130	On	.139 (3.53)	.140 (3.56)	.060 (1.52)
WY03	470	Special Order	.186 (4.72)	.185 (4.70)	.080 (2.03)
WY04	680		.240 (6.10)	.240 (6.10)	.080 (2.03)
WY05	2000		.420 (10.67)	.420 (10.67)	.090 (2.29)

**Values to 1000pF available in 50 WVDC rating.

ELECTRICAL CHARACTERISTICS AFTER LIFE TEST

Tested at 150% of Rated Voltage for 2000 Hours

Change in Capacitance at 25°C:	0.5% or 0.5 pF, max., whichever is greater.
Dissipation Factor at 1 KHz 25°C:	.0002 max.
Dissipation Factor at 1 KHz 125°C:	.002
Insulation Resistance at 25°C:	10 ⁶ megohms min.
Insulation Resistance at 125°C:	10 ⁵ megohms min.

ELECTRICAL CHARACTERISTICS AFTER MOISTURE TEST MIL-STD-202 Method 106

Capacitance Change 25°C:	0.5% or 0.5 pF, whichever is greater.
Dissipation Factor at 1 KHz 25°C:	.007
Dielectric Test Voltage:	200% rated voltage (WVDC)
Insulation Resistance, 25°C, 90/95% Relative Humidity:	10 ³ megohms min.
Insulation Resistance, 25°C, 50% Relative Humidity:	10 ⁵ megohms min.

ORDERING INFORMATION

High Q Uniceram Designation	Leaded Configurations	Case Size	Capacitance Code	No. of Zeroes	Capacitance Tolerance*
UY Fixed Capacitor (Glass encapsulated)	Axial Ribbon	0	1	Following the two digits of the capacitance value in pF.	B = ± .1pF
WY Chip Capacitor (unencapsulated)	Axial Wire	2	2		C = ± .25pF
	Radial Wire	6	3		D = ± .50pF
			4		F = ± 1%
			5		G = ± 2%
					J = ± 5%
					K = ± 10%

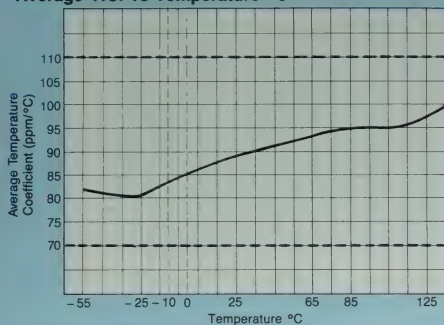
UNICERAM HIGH-Q UY SERIES

MINIATURE CERAMIC CAPACITORS

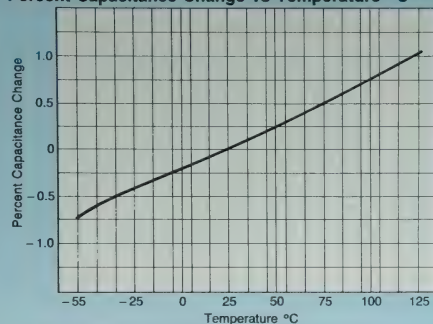
TYPICAL PERFORMANCE



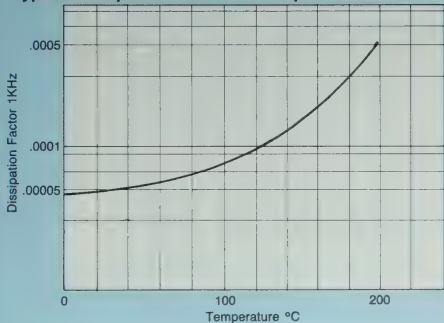
Average T.C. vs Temperature °C



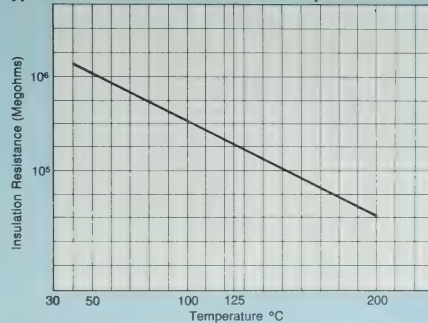
Percent Capacitance Change vs Temperature °C



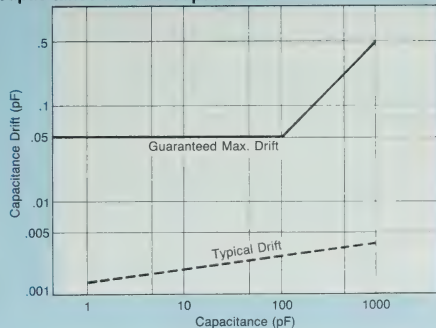
Typical Dissipation Factor vs Temperature °C



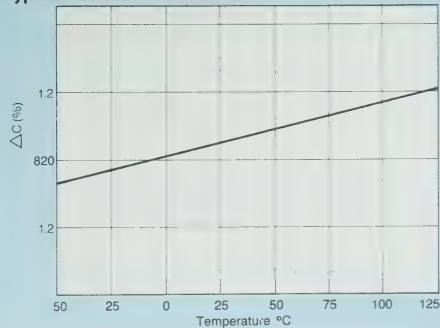
Typical Insulation Resistance vs. Temperature °C



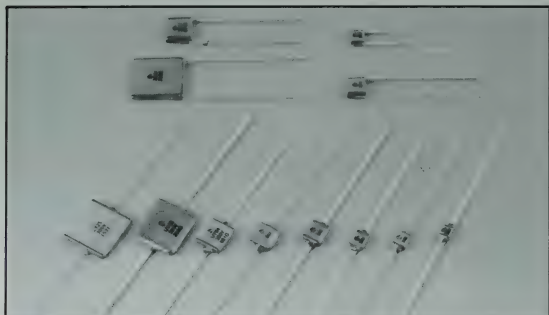
Capacitance Drift vs Capacitance



Typical Retrace Characteristics



UNICERAM HIGH K UY SERIES MINIATURE CERAMIC CAPACITORS



Uniceram High K ceramic capacitors are designed to exceed MIL-C-11015C and MIL-C-39014 military requirements.

New advanced production methods enable MENA to offer High K military grade capacitors at competitive industrial prices.

High K glass encapsulated capacitors employ the same proprietary band metalization process as MENA High Q capacitors to insure peel-proof and leach-proof terminations. High K capacitors also use fine silver leads that are bonded to the capacitor by a unique solderless technique.

Among their other significant features they also offer ruggedness, stability and inherent imperviousness to environmental elements and contaminants.

Choose from Uniceram High K miniature chips or glass encapsulated capacitors with the assurance of performance that will live up to your expectations.

FEATURES

- Over 1,000 glass encapsulated models with capacitances from .001 mfd to 1.0 mfd.
- High ratio of capacitance to unit volume for equivalent voltage, stability and current ratings.
- Glass encapsulated for resistance to surface contaminants and other environmental hazards.

SPECIFICATIONS

Capacitance Range:	1,000 pF to 1.0 mfd RMA values stocked in ranges listed below.
Tolerance:	See table on next page.
Dissipation Factor:	2.5% max. @ 1 KHz.
Insulation Resistance:	1000 megohm microfarad or 100,000 megohms whichever is less @ 25°C.
Temperature Coefficient:	± 15% max., - 55°C to + 125°C.
Voltage Temperature Coefficient:	+ 15%, - 25%; - 55°C to + 125°C.
Working Voltage:	50 WVDC, Except as noted.
Flash Test:	2 x WVDC (5 sec. @ 25°C, 50ma. Max.)
Life Test:	2 x WVDC @ 125°C, 1000 hrs.
Terminations:	Palladium Silver: Band-width standard, .015 min.
Test Sequence:	Capacitance, Dissipation Factor, Insulation Resistance, Flash Test.
Marking:	All capacitors are stamp marked with Co. I.D., Cap. Code and Tolerance.

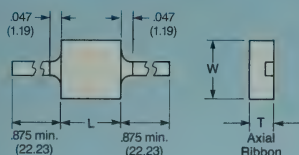
PART NO.		CAP. CODE	CAP. (mfd)	TOLERANCES**WVDC	
LEADED	CHIPS				
UY12 UY32 UY72	WK19	102	.001	K,M,Z	50
		152	.0015	K,M,Z	
		222	.0022	K,M,Z	
		332	.0033	K,M,Z	
		472	.0047	K,M,Z	
		682	.0068	K,M,Z	
		103	.010	K,M,Z	
UY14 UY34 UY74	WK22	153	.015	K,M,Z	50
		223	.022	K,M,Z	
		333	.033	K,M,Z	
		473	.047	K,M,Z	
		683	.068	K,M,Z	
		104	.10	K,M,Z	
		154	.15	K,M,Z	
UY15 UY35 UY75	WK23	224	.22	K,M,Z	50
		334	.33	K,M,Z	
		474	.47	K,M,Z	
		684	.68	K,M,Z	25
		105	1.0	K,M,Z	

Also available in 100 and 200 volts with reduced maximum capacity per case size.

UNICERAM HIGH K UY SERIES MINIATURE CERAMIC CAPACITORS

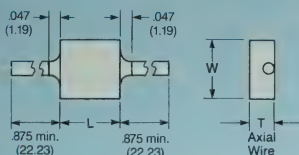


DIMENSIONS: in. (mm)



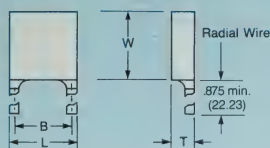
HIGH K SERIES w/AXIAL RIBBON LEAD

MODEL	L & W ± .031 (.78)	T ± .040	LEAD SIZE
UY12	.140 (3.56)	.060 (1.52)	.050 ± .003
UY14	.250 (6.35)	.070 (1.78)	(.127) X (.08)
UY15	.410 (10.41)	.080 (2.03)	.010 ± .003 (.25) (.08)



HIGH K SERIES w/AXIAL WIRE LEAD

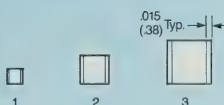
MODEL	L & W ± .031 (.78)	T ± .040 (1.01)	LEAD SIZE ± .003 (.08)
UY32	.140 (3.56)	.060 (1.52)	.023 (.58)
UY34	.250 (6.35)	.070 (1.78)	.023 (.58)
UY35	.410 (10.41)	.080 (2.03)	.023 (.58)



HIGH K SERIES w/RADIAL WIRE LEAD

MODEL	L & W ± .031 (.78)	T ± .040 (1.01)	B LEAD SPACING ± .025 (.64)	LEAD SIZE ± .003 (.08)
UY72	.140 (3.56)	.060 (1.52)	.125 (3.18)	.023 (.58)
UY74	.250 (6.35)	.070 (1.78)	.225 (5.72)	.023 (.58)
UY75	.410 (10.41)	.080 (2.03)	.375 (9.53)	.023 (.58)

ACTUAL CASE SIZE - UY



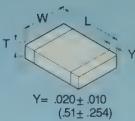
HIGH K UNENCAPSULATED CHIPS

MODEL	CHIP DIMENSIONS		
	L ± .031 (.78)	W ± .031 (.78)	T (max.)
WK19	.125 (3.18)	.095 (2.41)	.065 (1.65)
WK22	.225 (5.72)	.210 (5.33)	.065 (1.65)
WK23	.390 (9.91)	.425 (10.80)	.065 (1.65)

ORDERING INFORMATION

High Q Unicram Designation	Leaded Configurations	Case Size	Capacitance Code	No. of Zeroes	Capacitance Tolerance*
UY Fixed Capacitor (Glass encapsulated)	Axial Ribbon 1	2	First two digits of Capacitance Value in pF	Following the two digits of the capacitance value in pF.	K = ±10%
WK Chip Capacitor (unencapsulated)	Axial Wire 3	4			M = ±20%
	Radial Wire 7	5			Z = ±80, -20%

DIMENSIONS: in. (mm)

CDR01-06	TYPE MIL-C-55681	Length (L)	Width (W)	Thickness (T)	
				Min.	Max.
 <p>Y = .020 ± .010 (51 ± 254)</p>	CDR01	.080 ± .015 (2.03 ± .4)	.050 ± .015 (1.27 ± .4)	.020 (.51)	.055 (1.40)
	CDR02	.180 ± .015 (4.57 ± .4)	.050 ± .015 (1.27 ± .4)	.020 (.51)	.055 (1.40)
	CDR03	.180 ± .015 (4.57 ± .4)	.080 ± .015 (2.03 ± .4)	.020 (.51)	.080 (2.03)
	CDR04	.180 ± .015 (4.57 ± .4)	.125 ± .015 (3.18 ± .4)	.020 (.51)	.080 (2.03)
	CDR05	.180 ± .015 (4.57 ± .4) + .020 - .015 (.51 ± .254)	.250 ± .015 (6.35 ± .4) + .020 - .015 (.51 ± .254)	.020 (.51)	.080 (2.03)
	CDR06	.225 ± .020 (5.72 ± .5)	.250 ± .020 (6.35 ± .5)	.020 (.51)	.080 (2.03)
Termination codes available: M, S, U and W					

AVAILABLE VALUES

Military Type Designation	Cap. (pF)	Cap. Tol.	Rated Temp. and Volt. Limits	Rated Volt. DC
CDR01BP100B	10	J,K	BP	100
CDR01BP120BJ	12	J	BP	100
CDR01BP150B	15	J,K	BP	100
CDR01BP180BJ	18	J	BP	100
CDR01BP220B	22	J,K	BP	100
CDR01BP270BJ	27	J	BP	100
CDR01BP330B	33	J,K	BP	100
CDR01BP390BJ	39	J	BP	100
CDR01BP470B	47	J,K	BP	100
CDR01BP560BJ	56	J	BP	100
CDR01BP680B	68	J,K	BP	100
CDR01BP820BJ	82	J	BP	100
CDR01BP101B	100	J,K	BP	100
CDR01B-121B	120	J,K	BP,BX	100
CDR01B-151B	150	J,K	BP,BX	100
CDR01B-181B	180	J,K	BP,BX	100
CDR01BX221B	220	K,M	BX	100
CDR01BX271BK	270	K	BX	100
CDR01BX331B	330	K,M	BX	100
CDR01BX391BK	390	K	BX	100
CDR01BX471B	470	K,M	BX	100
CDR01BX561BK	560	K	BX	100
CDR01BX681B	680	K,M	BX	100
CDR01BX821BK	820	K	BX	100
CDR01BX102B	1000	K,M	BX	100
CDR01BX122BK	1200	K	BX	100
CDR01BX152B	1500	K,M	BX	100
CDR01BX182BK	1800	K	BX	100
CDR01BX222B	2200	K,M	BX	100
CDR01BX272BK	2700	K	BX	100
CDR01BX332B	3300	K,M	BX	100
CDR01BX392AK	3900	K	BX	50
CDR01BX472A	4700	K,M	BX	50

Failure Rate
Termination Finish
Capacitance Tolerance

Military Type Designation	Cap. (pF)	Cap. Tol.	Rated Temp. and Volt. Limits	Rated Volt. DC
CDR02BP221B	220	J,K	BP	100
CDR02BP271BJ	270	J	BP	100
CDR02BX392BK	3900	K	BX	100
CDR02BX472B	4700	K,M	BX	100
CDR02BX562BK	5600	K	BX	100
CDR02BX682B	6800	K,M	BX	100
CDR02BX822BK	8200	K	BX	100
CDR02BX103B	10000	K,M	BX	100
CDR02BX123AK	12000	K	BX	50
CDR02BX153A	15000	K,M	BX	50
CDR02BX183AK	18000	K	BX	50
CDR02BX223A	22000	K,M	BX	50
CDR03BP331B	330	J,K	BP	100
CDR03BP391BJ	390	J	BP	100
CDR03BP471B	470	J,K	BP	100
CDR03BP561BJ	560	J	BP	100
CDR03BP681B	680	J,K	BP	100
CDR03BP821BJ	820	J	BP	100
CDR03BP102B	1000	J,K	BP	100
CDR03BX123BK	12000	K	BX	100
CDR03BX153B	15000	K,M	BX	100
CDR03BX183BK	18000	K	BX	100
CDR03BX223B	22000	K,M	BX	100
CDR03BX273BK	27000	K	BX	100
CDR03BX333B	33000	K,M	BX	100
CDR03BX393AK	39000	K	BX	50
CDR03BX473A	47000	K,M	BX	50
CDR03BX563AK	56000	K	BX	50
CDR03BX683A	68000	K,M	BX	50

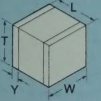
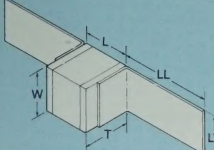
Failure Rate
Termination Finish
Capacitance Tolerance

CDR01-06 (BP, BX Material)

Military Type Designation	Cap. (pF)	Cap. Tol.	Rated Temp. and Volt. Limits	Rated Volt. DC
CDR04BP122BJ	1200	J	BP	100
CDR04BP152B	1500	J,K	BP	100
CDR04BP182BJ	1800	J	BP	100
CDR04BP222B	2200	J,K	BP	100
CDR04BP272BJ	2700	J	BP	100
CDR04BP332B	3300	J,K	BP	100
CDR04BX393BK	39000	K	BX	100
CDR04BX473B	47000	K,M	BX	100
CDR04BX563BK	56000	K	BX	100
CDR04BX823AK	82000	K	BX	50
CDR04BX104A	100000	K,M	BX	50
CDR04BX124AK	120000	K	BX	50
CDR04BX154A	150000	K,M	BX	50
CDR04BX184AK	180000	K	BX	50
CDR05BP392B	3900	J,K	BP	100
CDR05BP472B	4700	J,K	BP	100
CDR05BP562B	5600	J,K	BP	100
CDR05BX683B	68000	K,M	BX	100
CDR05BX823BK	82000	K	BX	100
CDR05BX104B	100000	K,M	BX	100
CDR05BX124BK	120000	K	BX	100
CDR05BX154B	150000	K,M	BX	100
CDR05BX224A	220000	K,M	BX	50
CDR05BX274AK	270000	K	BX	50
CDR05BX334A	330000	K,M	BX	50
CDR06BP682B	6800	J,K	BP	100
CDR06BP822B	8200	J,K	BP	100
CDR06BP103B	10000	J,K	BP	100
CDR06BX394AK	390000	K	BX	50
CDR06BX474A	470000	K,M	BX	50

Failure Rate
Termination Finish
Capacitance Tolerance

DIMENSIONS: in. (mm)

CDR11-14, CY81-84 Chip Pellet	TYPE MIL-C-		Style	Termination Codes	Length (L)	Width (W)	Thickness (T)	
	55681	11272					Min.	Max.
	CDR11	CY81	Chip	M	.055 ± .015 (1.40 ± .4)	.055 ± .015 (1.40 ± .4)	.020 (.51)	.057 (1.45)
	CDR12	CY82	Pellet	S,U	.055 ± .025 (1.40 ± .6)	.055 ± .015 (1.40 ± .4)	.020 (.51)	.057 (1.45)
	CDR13	CY83	Chip	M	.110 ± .020 (2.79 ± .5)	.110 ± .020 (2.79 ± .5)	.030 (.76)	.102 (2.59)
	CDR14	CY84	Pellet	S,U	.110 ± .035 - .020 (2.79 ± .9) - .5)	.110 ± .020 (2.79 ± .5)	.030 (.76)	.102 (2.59)
	Termination Band, Y: .055 (1.40) Size, .010 + .010 - .005 (.254 + .254) .110 (2.79) Size, .015 ± .010 (.381 ± .254)							
	Case Size Designation: .055 (1.40) size is 1 .110 (2.79) size is 2							
	CDR21 is equivalent to case size 2. Lead: Silver microstrip ribbon .093 ± .005 (2.36 ± .127) = LW .004 ± .001 (.101 ± .025) Thick Attached with high temperature solder .250 min. (6.35 min.) = LL							
CDR21	TYPE MIL-C-55681		Style	Termination Code	Length (L)	Width (W)	Thickness (T)	
	CDR21						Min.	Max.
			Microstrip	T	.135 ± .015 (3.43 ± .4)	.110 ± .015 (2.79 ± .3)	.030 (.8)	.100 (2.54)

AVAILABLE VALUES

CDR11-14, 21 (BG, BP Material)

CY81-84 (BG Material only)

Cap. Code	Cap. (pF)	Cap. Tol.	V-Temp. Limits Code	(WVDC) Case Size	
				1	2
0R1	0.1	B	BG, BP	50	500
0R2	0.2	B	BG, BP	50	500
0R3	0.3	BC	BG, BP	50	500
0R4	0.4	BC	BG, BP	50	500
0R5	0.5	BCD	BG, BP	50	500
0R6	0.6	BCD	BG, BP	50	500
0R7	0.7	BCD	BG, BP	50	500
0R8	0.8	BCD	BG, BP	50	500
0R9	0.9	BCD	BG, BP	50	500
1R0	1.0	BCD	BG, BP	50	500
1R1	1.1	BCD	BG, BP	50	500
1R2	1.2	BCD	BG, BP	50	500
1R3	1.3	BCD	BG, BP	50	500
1R4	1.4	BCD	BG, BP	50	500
1R5	1.5	BCD	BG, BP	50	500
1R6	1.6	BCD	BG, BP	50	500
1R7	1.7	BCD	BG, BP	50	500
1R8	1.8	BCD	BG, BP	50	500
1R9	1.9	BCD	BG, BP	50	500
2R0	2.0	BCD	BG, BP	50	500
2R1	2.1	BCD	BG, BP	50	500
2R2	2.2	BCD	BG, BP	50	500
2R4	2.4	BCD	BG, BP	50	500
2R7	2.7	BCD	BG, BP	50	500
3R0	3.0	BCD	BG, BP	50	500
3R3	3.3	BCD	BG, BP	50	500
3R6	3.6	BCD	BG, BP	50	500
3R9	3.9	BCD	BG, BP	50	500
4R3	4.3	BCD	BG, BP	50	500
4R7	4.7	BCD	BG, BP	50	500
5R1	5.1	BCD	BG, BP	50	500
5R6	5.6	BCD	BG, BP	50	500
6R2	6.2	BCD	BG, BP	50	500
6R8	6.8	BCJKM	BG, BP	50	500
7R5	7.5	BCJKM	BG, BP	50	500
8R2	8.2	BCJKM	BG, BP	50	500
9R1	9.1	BCJKM	BG, BP	50	500

Cap. Code	Cap. (pF)	Cap. Tol.	V-Temp. Limits Code	(WVDC) Case Size	
				1	2
100	10	FGJKM	BG, BP	50	500
110	11	FGJKM	BG, BP	50	500
120	12	FGJKM	BG, BP	50	500
130	13	FGJKM	BG, BP	50	500
150	15	FGJKM	BG, BP	50	500
160	16	FGJKM	BG, BP	50	500
180	18	FGJKM	BG, BP	50	500
200	20	FGJKM	BG, BP	50	500
220	22	FGJKM	BG, BP	50	500
240	24	FGJKM	BG, BP	50	500
270	27	FGJKM	BG, BP	50	500
300	30	FGJKM	BG, BP	50	500
330	33	FGJKM	BG, BP	50	500
360	36	FGJKM	BG, BP	50	500
390	39	FGJKM	BG, BP	50	500
430	43	FGJKM	BG, BP	50	500
470	47	FGJKM	BG, BP	50	500
510	51	FGJKM	BG, BP	50	500
560	56	FGJKM	BG, BP	50	500
620	62	FGJKM	BG, BP	50	500
680	68	FGJKM	BG, BP	50	500
750	75	FGJKM	BG, BP	50	500
820	82	FGJKM	BG, BP	50	500
910	91	FGJKM	BG, BP	50	500
101	100	FGJKM	BG, BP	50	500
111	110	FGJKM	*BG, BP	50	300
121	120	FGJKM	*BG, BP	50	300
131	130	FGJKM	*BG, BP	50	300
151	150	FGJKM	*BG, BP	50	300
161	160	FGJKM	*BG, BP	50	300
181	180	FGJKM	*BG, BP	50	300
201	200	FGJKM	*BG, BP	50	300
221	220	FGJKM	*BG, BP	50	200
241	240	FGJKM	*BG, BP	50	200
271	270	FGJKM	*BG, BP	50	200

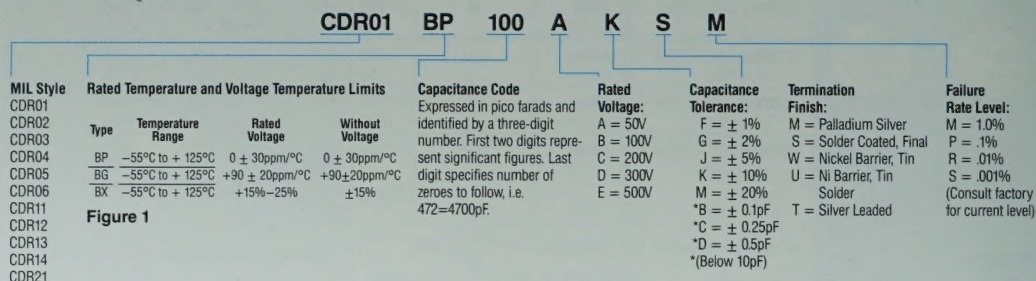
Cap. Code	Cap. (pF)	Cap. Tol.	V-Temp. Limits Code	(WVDC) Case Size	
				1	2
301	300	FGJKM	*BG, BP	50	200
331	330	FGJKM	*BG, BP	50	200
361	360	FGJKM	*BG, BP	50	200
391	390	FGJKM	*BG, BP	50	200
431	430	FGJKM	*BG, BP	50	200
471	470	FGJKM	*BG, BP	50	200
511	510	FGJKM	*BG, BP	50	100
561	560	FGJKM	*BG, BP	50	100
621	620	FGJKM	*BG, BP	50	100
681	680	FGJKM	*BG, BP	50	50
751	750	FGJKM	*BG, BP	50	50
821	820	FGJKM	*BG, BP	50	50
911	910	FGJKM	*BG, BP	50	50
102	1000	FGJKM	*BG, BP	50	50
112	1100	FGJKM	**BP	—	50
122	1200	FGJKM	**BP	—	50
132	1300	FGJKM	**BP	—	50
152	1500	FGJKM	**BP	—	50
162	1600	FGJKM	**BP	—	50
182	1800	FGJKM	**BP	—	50
202	2000	FGJKM	**BP	—	50
222	2200	FGJKM	**BP	—	50
242	2400	FGJKM	**BP	—	50
272	2700	FGJKM	**BP	—	50
302	3000	FGJKM	**BP	—	50
332	3300	FGJKM	**BP	—	50
362	3600	FGJKM	**BP	—	50
392	3900	FGJKM	**BP	—	50
432	4300	FGJKM	**BP	—	50
472	4700	FGJKM	**BP	—	50
502	5000	FGJKM	**BP	—	50
512	5100	FGJKM	**BP	—	50

*BP only Case Size 1, 100pF to 1000pF. Consult factory for availability.

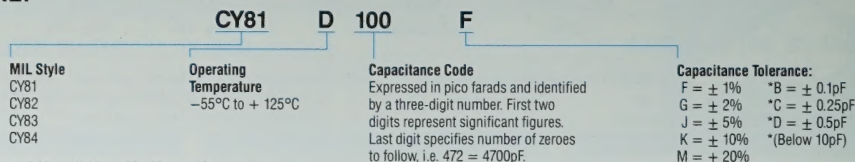
**BP only Case Size 2, above 1000pF. Consult factory for availability.

PART NUMBERING SYSTEM

MIL-C-55681, ALL STYLES



MIL-C-11272 ONLY



NOTE:

In this series, only BG type material is available, +90±20ppm/°C. The failure rate code is not applicable. CY81, 82 have palladium silver terminations. CY82, 84 have solder coated terminations.

MARKING

Styles CDR01-06 and CY81-84 Typically have no marking on the units.

Styles CDR11-14, 21

Have a green dot to indicate the vertical electrode plate orientation.

All styles are available with optional marking. Contact the factory for details.

PACKAGING

All styles are typically bulk packaged. Individual packaging is available.

All styles, except CDR21, are available in embossed tape packaging (8 or 12mm as applicable for unit size), and reeled per E.I.A. specification RS481 for automatic insertion. Contact the factory for details and minimum quantity.

CUSTOMER ASSISTANCE

Please contact the Product Manager, Hi-Rel/Hi-Q Capacitor products at Murata Erie North America, Inc., State College Division.

PERFORMANCE SPECIFICATIONS

ELECTRICAL 25°C or as indicated

Capacitance

Values available as shown in tables, tested per Method 305, MIL-STD-202 and MIL-C-55681 or MIL-C-11272.

Dissipation Factor

Tested per Method 305, MIL-STD-202, BP ≤ 0.15%, BG ≤ 0.05%, BX ≤ 2.5%.

Quality Factor (CDR11-14, 21)

Measured at 10MHz, shall meet or exceed values indicated in Figure 1, MIL-C-55681.

Insulation Resistance

Tested per Method 302, MIL-STD-202 at 50mA max. Units shall meet or exceed values indicated in MIL-C-55681.

Dielectric Withstanding Voltage

Tested per Method 301, MIL-STD-202, 5 ± 1 seconds, at 50mA max. Units shall withstand 250% of rated voltage.

Voltage-Temperature Limits, -55°C to +125°C.

Units shall exhibit changes in capacitance not exceeding limits in Table MIL-C-55681.

Resonance (CDR11-14, 21 only)

Tested per MIL-C-55681. Shall meet minimum series resonance value indicated in Fig. 3, MIL-C-55681.

ENVIRONMENTAL

Life Test

In accordance with Method 108, MIL-STD-202, Test Condition F (2000 hours) at 125°C and twice rated voltage.

Moisture Resistance

In accordance with Method 106, MIL-STD-202, 20 cycles with 50VDC bias.

Thermal Shock and Immersion

In accordance with Method 107, Test Condition A (-55°C to +125°C, 5 cycles) and Method 104, Test Condition B respectively of MIL-STD-202.

ASSEMBLY DURABILITY

Resistance to soldering heat

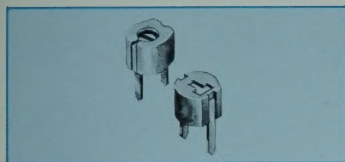
In accordance with Method 210, MIL-STD-202, with 8 hours steam aging, Test Condition B.

Terminal Strength (CDR21 Only)

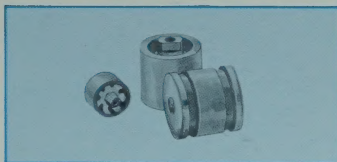
In accordance with Method 211 MIL-STD-202, Test Condition B (5 Bends).

HIGH RELIABILITY TESTING

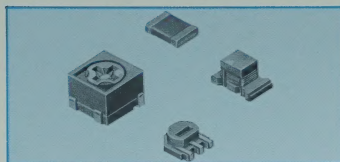
Murata Erie maintains high reliability screening facilities in several locations. Please contact us for your special testing requirements for these military specification capacitors and other ceramic capacitor types, including High Voltage, RF Power and Microwave.



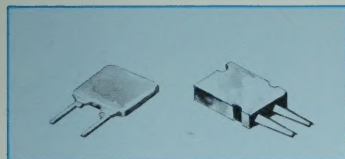
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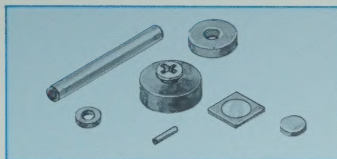
HIGH VOLTAGE CERAMIC CAPACITORS...
from 7.5KV to 40 KV in capacities and power handling capabilities for every application requirement.



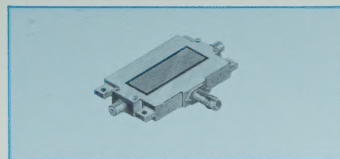
SURFACE MOUNTED COMPONENTS...
capacitors, inductors, resistors, potentiometers and more for state-of-the-art circuit applications.



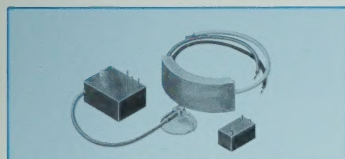
CERAMIC RESONATORS...
for low cost microprocessor applications in low KHz to medium MHz frequency ranges.



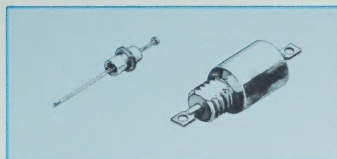
RESOMICS...
ceramic microwave dielectric resonators for filters, oscillators, and waveguides to 50GHz with Q's over 10,000.



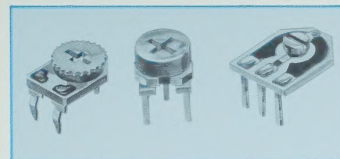
GIGAFIL... microwave filters offering exceptional temperature stability for mobile communication and other systems applications.



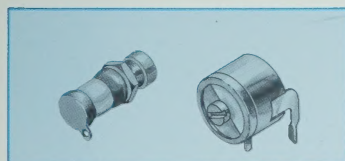
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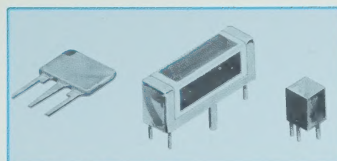
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L, T, Pi and C types to 30 GHz in a variety of configurations including filter connectors. Many to MIL specifications.



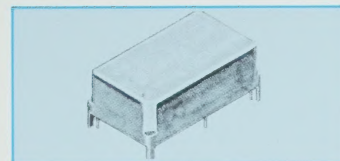
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low cost single-turn trimming potentiometers in many sizes and configurations. Single and multi-turn sealed precision units.



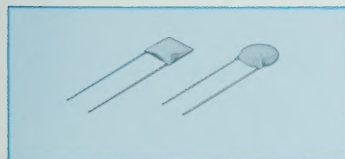
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single-turn ceramic and multi-turn air to meet virtually every application requirement from commercial to MIL.



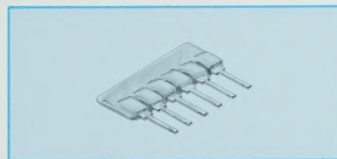
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for both communications and consumer AM, FM and TV applications in IF and discriminator circuits.



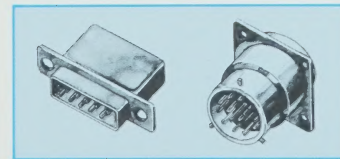
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Miniature microwave oscillators using dielectric resonators.



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